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European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
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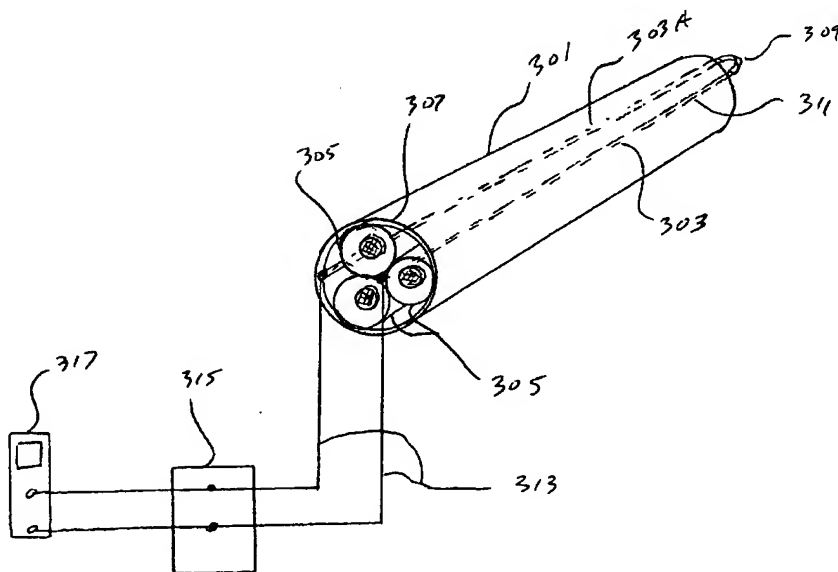
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[Continued on next page]

(54) Title: AN ELECTRICAL CONDITION MONITORING METHOD FOR POLYMERS



(57) Abstract: An electrical condition monitoring method utilizes measurement of electrical resistivity of an age sensor (303) made of a conductive matrix or composite disposed in a polymeric structure such as an electrical cable (301). The conductive matrix comprises a base polymer and conductive filler. Cable (301) includes insulated conductors (305). Shunt (309) connects age sensor (303) with second element (303A) in a series connected age sensor loop (311). The method includes use of conductors (313) to connect age sensor loop (31) to terminal box (315) for communicating the resistivity to measuring instrument (317) and correlation of the resistivity of the conductive matrix of the polymeric structure with resistivity of an accelerated-aged conductive composite.



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01N 27/20, 27/04, 33/44; G01R 31/02; 31/08

US CL : 324/693, 543, 544 ; 73/866

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 324/693, 543, 544, 691, 541, 555 ; 73/866, 865.6, 865.9, 786, 802

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category * | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---------------|--|----------------------------------|
| Y --- A | US 5,789,665 A (VOELKER et al) 04 August 1988 (04.08.1988), abstract and Figs. 1-2 and 4 | 1-10 and 13-31 ----- 11-12 |
| Y --- A | JP 61-44339 A (KONDO, et al) 04 March 1986, abstract and Fig. 1 | 1-10 and 13-31 ----- 11-12 |
| Y | US 4,520,341 A (MIYOSHI et al) 28 May 1985 (28.05.1985), Figs. 3 and 5-6 and col. 1, lines 45-49 | 1-10 and 13-31 |
| Y | US 4,988,875 A (ORTIZ et al) 29 January 1991 (29.01.1991), abstract and Fig. 1 | 1-10 and 13-31 |

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Further documents are listed in the continuation of Box C.

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See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T"

later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X"

document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y"

document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"

document member of the same patent family

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/06844

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.: 1-31

Remark on Protest

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☐

The additional search fees were accompanied by the applicant's protest.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

PCT/US03/06844

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Group I has the special technical feature of having conductive particles added to the polymer being monitored which is not required in Group II. Group II has the special technical feature of having conductive particles added to a second polymer which is not required in Group I as evidenced as such at most being claimed only in base claim 1 of Group I and not the other two base claims of Group I, claims 17 and 25.

Group I, claim(s) 1-31, drawn to a method of determining degradation of a polymer, a degradation sensor for a polymeric structure or a polymeric structure.

Group II, claim(s) 32-38, drawn to a method of determining degradation of a first polymer, a condition-sensing electrical cable, a condition-sensing building component or a condition sensing vehicle.

Continuation of B. FIELDS SEARCHED Item 3:

IBM_TDB, US-PGPUB, EPO, JPO, DERWENT, USOCR, USPAT

search terms (plurals included automatically): degradation, degrade, degraded, degrading, deterioration, deteriorate, deteriorated, deteriorating, polymeric, polymer, plastic, conductive, conducting, metal, metallic, carbon, black, carbon-black, particle